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DECLARATION OF TRANSLATOR

I, Lawrence B. Hanlon, of the International Translation Center, Inc., do hereby avow and declare that I am conversant with the English and German languages and am a competent translator of German into English. I declare further that to the best of my knowledge and belief the following is a true and correct English translation prepared and reviewed by me of the document in the German language attached hereto.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of any patent issued thereon.

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Wire Cloth, in Particular Paper Making Wire Cloth

The invention relates to wire cloth, in particular paper making wire cloth, consisting of at least two fabric layers, the upper fabric layer being formed from making direction wires and from cross direction wires, the lower fabric layer being formed from making direction wires and from cross direction wires, and for individual fabric layers wire bridges being formed such that they do not have any binding to other wires over a definable path extension within a pattern repeat.

The dewatering of the fibrous material suspension applied to the wire cloth from above by filtration acquires major importance in the pertinent papermaking process. The fibrous material suspension is mixtures of suitable fibers, fillers, auxiliary chemical agents, and water which forms most of the mixture. In the paper industry this filtration process is often also called sheet formation and takes place in the so-called wet or sheet forming part of the papermaking machine.

In order to be able to produce a paper sheet as uniform as possible, it is necessary to increase the proportion of water to on average 99% within the fibrous material suspension immediately before sheet formation. During the sheet forming process this proportion is reduced to roughly 80% again by filtration. The paper fibers and the fillers and auxiliary agents remain as fiber mat on the papermaking wire cloth.

While in the past dewatering took place mainly by papermaking wire cloth on Fourdrinier paper machines, double screen machines are being used more and more often today, preferably so-called gap formers. They are also characterized in that the fibrous material suspension is sprayed directly into the gap between the two papermaking screens and is dewatered by the two screens. With this type of papermaking machine it has been possible to accelerate the filtration process such that production rates of 2000 meters/min and more are possible today.

One special field within the papermaking industry is the production of so-called sanitary paper, such as Kleenex® tissues, toilet paper, paper towels, or the like. The type of paper being used here are characterized mainly by especially low G.S.M. between 10 and 20 g/m^2 depending on the application. Graphic types of paper in comparison are between 42 and 120 g/m^2.

In order to form a uniform sheet with such a low G.S.M., dilution of the fibrous material suspension which is higher than for other types of paper is required. The concentration of fibrous material drops to approximately 0.3 to 0.5%. In order to be able to also effectively produce these types of paper, this larger amount of water must take place in as short a time as possible, that is to say, at the highest production speeds. At the same time of course retention of the fibrous material should remain as high as possible, that is to say, only a small portion of the added fibers should be removed with water.

In the prior art (EP 0 069 101 A1, EP 0 116 945 A1, EP 0 794 283 A1, and DE 100 30 650 A1) composite fabrics are known as papermaking wire cloths; they consist of two more or less independent single-layer wire cloths which, connected to each other in different ways, for the most part maintain an open surface so that the high required dewatering performance is thus guaranteed. The indicated known solutions are aimed in most instances at suitably joining a uniform paper side in the form of a two-strand fabric, also called a basket weave, to the most varied machine sides in a

suitable manner. But often, decreasing fibrous material retention favors high dewatering performance since the long wire bridges of the cross direction wires which are necessary for retention are not sufficiently available.

The joining of two single-layer fabrics into the papermaking wire cloth, in which longer wire bridges are formed by cross direction wires, is disclosed in EP 0 889 160 A1. The paper side (top) is implemented by a four-strand twill weave and the machine side (bottom) is implemented by a four-strand basket weave. The two layers are joined by binding of a paper-side making direction wire to a machine-side cross direction wire. This type of fabric is characterized both by higher dewatering performance and also by good fiber support based on the long wire bridges. In the known solution, marking which is caused by the type of joining of the layers and which is no longer acceptable today often occurs. Furthermore, the wear potential is limited, i.e., the machine side which is formed largely by the making direction wires is exposed directly to wear and as a result seam or wire cloth cracks can occur in use. Furthermore, the flexural stiffness in the transverse direction is limited due to the four-strand machine side and automatic seaming which is difficult to manage and which is caused by the lower making direction threads running parallel.

On the basis of this prior art, the object of this invention therefore is to further improve the known wire cloth designs while maintaining their advantages such that especially in the area of producing sanitary paper there are very high dewatering performance and fiber support. At the same time, the fabric should be thin, but nevertheless mechanically stable against washboard marks and distortion and should still have good flexural stiffness values in the transverse direction and ensure the possibility of advantageous seaming for joining the ends of the wire cloth. This object is achieved by a wire cloth, in particular a papermaking wire cloth, with the features of claim 1 in its entirety.

In that, as specified in the characterizing part of claim 1, the wire bridges of the upper cross direction wires run within a pattern repeat at least over nine making direction wires and at most under one making direction wire, because the wire bridges of the lower cross direction wires within a pattern repeat run at least under six and over at least two making direction wires, and because between two making direction wires which run over a cross direction wire at least one other making direction wire runs under the same cross direction wire, on the upper or paper side the long wire bridges which are necessary for good fiber support are obtained from cross direction wires which in conjunction with the open warp ensures the required permeability for the required high dewatering performance. In addition to better fiber support, the long wire bridges act advantageously with respect to bending stability in the transverse direction of the wire cloth. The bottom or machine side moreover due to the double binding of the lower cross direction wires ensures high stability with respect to diagonal distortion. Moreover high wear resistance in the papermaking machine is achieved by the lower cross direction wires running under at least six making direction wires.

If the wire cloth is built up preferably from plastic filaments during production or then thermofixed, the applied tension in the direction in which the machine runs results in that the two binding making direction wires at the binding point move toward each other and in this way additionally enlarge the open areas of the wire cloth. Thus, on the one hand the permeability increases and on the other the lower cross direction wire is more strongly bent and continues to protrude from the lower or machine side, and in this way can be to a larger extent "ground down" in the papermaking machine. In one preferred embodiment of the wire cloth as claimed in the invention, the top and bottom sides are formed from the same number of making direction wires, there not needing to be any fixed assignment of individual making direction wires to one of the two sides. The number of cross direction wires on the top or paper side is higher than on the bottom or machine side.

The joining of the two fabric layers to each other can be effected in different ways, for example in the form of using additional binding wires which can be made as cross direction wires or making direction wires. Another possibility of connection is so-called integral connection using the existing wires typical of the binding, also called structure wires, such as making direction wire or cross direction wire, which can be made both as tying and also as a replacement of two adjacent wires or wire systems.

Other advantageous embodiments of the wire cloth as claimed in the invention are the subject matter of the other dependent claims.

The wire cloth as claimed in the invention, in particular papermaking wire cloth, will be detailed below using various exemplary embodiments as shown in the drawings. The figures are schematic and not to scale.

FIG. 1a shows how the making direction wires run in a first exemplary embodiment of the wire cloth along the cutting line A-A in FIG. 1b and in FIG. 1c, the layers being joined by replacement of the making direction wires;

FIG. 1b shows a top view of one extract of the top or paper side;

FIG. 1c shows a top view of one extract of the lower or machine side without the upper cross direction wires as a section between the fabric layers 1T and 1B as shown in FIG. 1a;

FIG. 2a shows how the making direction wires run in a second exemplary embodiment of the wire cloth along the cutting line B-B in FIG. 2b and in FIG. 2c, the layers being joined by replacement of the making direction wires;

FIG. 2b	shows a top view of one extract of the top or paper side;
FIG. 2c	shows a top view of one extract of the lower or machine side without the upper cross direction wires as a section between the fabric layers 2T and 2B as shown in FIG. 2a;
FIG. 3a	shows how the making direction wires run in a third exemplary embodiment of the wire cloth along the cutting line C-C in FIG. 3b and in FIG. 3c, the layers being joined by replacement of the making direction wires;
FIG. 3b	shows a top view of one extract of the top or paper side;
FIG. 3c	shows a top view of one extract of the lower or machine side without the upper cross direction wires as a section between the fabric layers 3T and 3B as shown in FIG. 3a;
FIG. 4a	shows how the making direction wires run in a fourth exemplary embodiment of the wire cloth along the cutting line D-D in FIG. 4b and in FIG. 4c, the layers being joined by replacement of the making direction wires;
FIG. 4b	shows a top view of one extract of the top or paper side;
FIG. 4c	shows a top view of one extract of the lower or machine side without the upper cross direction wires as a section between the fabric layers 4T and 4B as shown in FIG. 4a.

The wire cloth shown in FIG. 1a, 1b, 1c in the form of the papermaking wire cloth implements the fabric as claimed in the invention with a ratio of cross direction wires from the top (121 to 130) to the bottom (141 to 145) of 2:1 and joining of the two fabric layers 1T and 2T by the replacement of two directly adjacent making direction wires 101 to 110 which are used as a functional pair. In this connection the following making direction wires can be regarded as pairs, specifically 101, 102; 103, 104; 105, 106; 107, 108, and 109 and 110. If the reference numbers have an apostrophe, that is, for example 101' instead of 101, this means that the following repeat is being addressed.

The second exemplary embodiment as shown in FIGS. 2a to 2c relates to a papermaking wire cloth as claimed in the invention described comparably to the version as above, by the altered configuration of the tying sites of the making direction wires 201 to 210 on the top a modified nature of the paper side having been achieved, such that there are only few markings in the paper. In this exemplary embodiment the ratio of the cross direction wires from the top side 121 to 130 to the bottom side 141 to 145 is 2:1 and connection of the fabric layers 2T and 2B takes place by replacement of two directly adjacent making direction wires 201 to 210 which are used as a functional pair. In this connection the following making direction wires.can be regarded as pairs 201, 202; 203, 204; 205, 206; 207, 208, and 209 and 210.

In the third exemplary embodiment as shown in FIG. 3a, 3b, 3c, the fabric as claimed in the invention with a ratio of cross direction wires from the top side 321 to 335 to the bottom side 341 to 350 of 3:2 and joining of the two fabric layers 3T and 3B is implemented by the tying of the upper making direction wires 301 to 305 to the lower cross direction wires 341 to 350. Here the binding site is chosen such that it lies exactly between the binding sites of the lower making direction wires 306 to 310 and is thus protected against wear from the bottom.

The fourth exemplary embodiment as shown in FIGS. 4a, 4b, 4c shows the fabric as claimed in the invention with a ratio of cross direction wires from the top side 441 to 455 to the bottom side 371 to 480 of 3:2 and joining of the two fabric layers 4T and 4B by a separate binding wire 461 to 465 which is made here as a cross direction wire.

The diameter of the upper making direction wires can be equal to the diameter of the lower making direction wires; but the possibility also exists of choosing the diameter of the upper making direction wires to be less than or equal to the diameter of the lower making direction wires. Furthermore, the diameter of the upper cross direction wires can be smaller than that of the lower cross section wires. If making direction wires are addressed in the text of the application, they represent the so-called warp threads of the fabric and the cross making direction wires are the so-called weft threads. If the flexural stiffness of the wire cloth in the transverse direction is addressed, the transverse direction for the wire cloths runs perpendicular to the latter, for example vertically along line A-A in FIG. 1b. The direction in which the machine runs can then be viewed as parallel to line A-A in FIG. 1b. Furthermore, for preparing the fabric it is fundamentally possible to interchange the making direction wires and the cross making direction wires if a special weave form should make this necessary